

**TO:** Board Members

**THROUGH:** Kevin Patteson, Executive Administrator  
Robert E. Mace, Deputy Executive Administrator, Water Science  
& Conservation

**FROM:** Sanjeev Kalaswad, Director, Conservation & Innovative Water  
Technologies

**DATE:** October 31, 2014

**SUBJECT:** Five-Year Plan for Mapping Brackish Aquifers in Texas and Assessing  
their Storage Potential for Aquifer Storage and Recovery

## **ACTION REQUESTED**

No action is required. This is a briefing and discussion on a five-year plan to map and characterize brackish aquifers in the state and assess their storage potential for aquifer storage and recovery.

## **BACKGROUND**

Texas has an estimated 2.7 billion acre-feet of brackish water (water with total dissolved solids concentrations ranging between 1,000 and 10,000 milligrams per liter) in its aquifers. The Brackish Resources Aquifer Characterization System program was established in late 2009 with funding from the 81<sup>st</sup> Texas Legislature. Its goal is to map and characterize the brackish portions of the aquifers in sufficient detail to provide useful information and data to regional water planning groups and other entities interested in using brackish groundwater for desalination supplies such as those recommended in the 2012 State Water Plan.

Since 2009, we have completed three brackish aquifer mapping studies: a pilot study of the Pecos Valley Aquifer in West Texas; the Queen City-Sparta aquifers in part of a two-county area in south-central Texas; and the Gulf Coast Aquifer in a four-county area in the Lower Rio Grande Valley. A fourth study (Carrizo-Wilcox and associated aquifers in a nine-county area in southcentral Texas) is presently ongoing and planned for completion in spring 2015.

### **Our Mission**

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

### **Board Members**

Carlos Rubinstein, Chairman | Bech Bruun, Member | Kathleen Jackson, Member  
Kevin Patteson, Executive Administrator

Brackish aquifers also offer the potential to serve as storage locations for aquifer storage and recovery systems. Aquifer storage and recovery is an underground water management strategy that is being used in many places in the United States to store excess water in times of plenty for later use when needed.

## **KEY ISSUES**

There are 30 major and minor aquifers in Texas. All except four (Marathon, Rita Blanca, Igneous, and Marble Falls aquifers) are known to contain brackish groundwater. Additionally, there are areas of the state such as in and around Wichita Falls that do not have designated aquifers but are underlain by geological formations that may contain salty groundwater that can be used for desalination. Some of these geological formations are included in our mapping plan.

There are many common elements in mapping brackish aquifers and assessing the storage potential of aquifers for aquifer storage and recovery. For example, we mapped an area in Nueces and San Patricio counties (TWDB Open-File Report 12-01, 2012) to assess its suitability for aquifer storage and recovery. Therefore, we propose that this additional work of mapping a brackish aquifer's storage potential for aquifer storage and recovery be included in the mapping projects wherever needed or suitable.

The plan outlined below is to map and characterize over the next five years (January 2015 through December 2019) portions of some of the 25 aquifers that we have not yet mapped and which are known to contain brackish groundwater.

### **Five-year plan (2015 to 2020) to map aquifers for brackish groundwater and their storage potential for aquifer storage and recovery**

Beginning January 1, 2015, we plan to start mapping and characterizing aquifers and aquifer sections that have been identified in the 2012 State Water Plan as source water for recommended desalination plants. Also included in our plan are other aquifers that are not listed in the state water plan but are presently being considered by entities as potential water sources because of the ongoing drought. Mapping the storage potential of some aquifers for aquifer storage and recovery is also included in our plan.

The sequence of our planned studies, the exact geographical extent of the study areas, the scope of work and schedule for each study, and conducting the study itself are all subject to change depending on prevailing needs, priorities, and resources. Studies of aquifers and aquifer sections not included in the five-year plan will be continued into the future.

The planned study areas (Table 1 and Figure 1) are:

- Study 1: Permian-Pennsylvanian formations in and around Wichita Falls**  
Number of staff: Three (3)  
Schedule: January to December 2015 (12 months)  
Type of mapping: Brackish aquifer and aquifer storage and recovery  
Reason for study: Emergency; no alternate source of water in the area
- Study 2: Aquifers of the Upper Coastal Plain (Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers) - Central**  
Number of staff: One and one-half (1.5)  
Schedule: Ongoing brackish study to be completed June 2015 and the aquifer storage and recovery in December 2015  
Type of mapping: Brackish aquifer and aquifer storage and recovery  
Reason for study: Desalination and aquifer storage and recovery listed in the 2012 State Water Plan
- Study 3: Permian-Pennsylvanian formations of Texas (Blaine Aquifer)**  
Number of staff: Two and one-half (2.5)  
Schedule: January to June 2016 (6 months)  
Type of mapping: Brackish aquifer only; no population centers in area that have need for aquifer storage and recovery  
Reason to study: Alternate source of water for Wichita Falls if results of Study 1 are not promising
- Study 4: Aquifers of the Upper Coastal Plain (Carrizo-Wilcox and Yegua-Jackson aquifers) - South**  
Number of staff: Two (2)  
Schedule: January 2016 to December 2017 (24 months)  
Type of mapping: Brackish aquifer only; Laredo has already conducted an aquifer storage and recovery feasibility study  
Reason for study: Desalination listed in the 2012 State Water Plan
- Study 5: Cretaceous aquifers (Edwards-Trinity [Plateau], Trinity aquifers) – Central**  
Number of staff: Two and one-half (2.5)  
Schedule: July 2016 to June 2018 (24 months)  
Type of mapping: Brackish aquifer and aquifer storage and recovery  
Reason for study: Aquifer storage and recovery in the 2012 State Water Plan
- Study 6: Gulf Coast Aquifer - Central**  
Number of staff: Two (2)  
Schedule: January 2018 to June 2020 (30 months)  
Type of mapping: Brackish aquifer and aquifer storage and recovery  
Reason to study: Aquifer storage and recovery in the 2012 State Water Plan

**Study 7: Cretaceous aquifers (Edwards-Trinity [Plateau] Aquifer) – Western**

Number of staff: One (1)

Schedule: July 2018 to December 2019 (18 months)

Type of mapping: Brackish aquifer

Reason to study: Desalination listed in 2012 State Water Plan

**Study 8: Bone Spring-Victorio Peak Aquifer**

Number of staff: One and one-half (1.5)

Schedule: July 2018 to December 2019 (18 months)

Type of mapping: Brackish aquifer

Reason to study: Desalination listed in 2012 State Water Plan

**Table 1. Study areas, schedule, and staff allocation for planned brackish aquifer and aquifer storage and recovery studies, 2015 to 2020**

Year	2015				2016				2017				2018				2019			
Study 1	3 staff (BRACS + ASR)																			
Study 2	1.5 staff (BRACS + ASR)																			
Study 3					2.5 staff (BRACS)															
Study 4					2 staff (BRACS)															
Study 5							2.5 staff (BRACS + ASR)													
Study 6													2 staff (BRACS + ASR)							
Study 7															1 staff (BRACS)					
Study 8															1.5 staff (BRACS)					

**Notes:**

*BRACS: Brackish Resources Aquifer Characterization System*

*ASR: Aquifer storage and recovery*

*Study areas are described in the text*

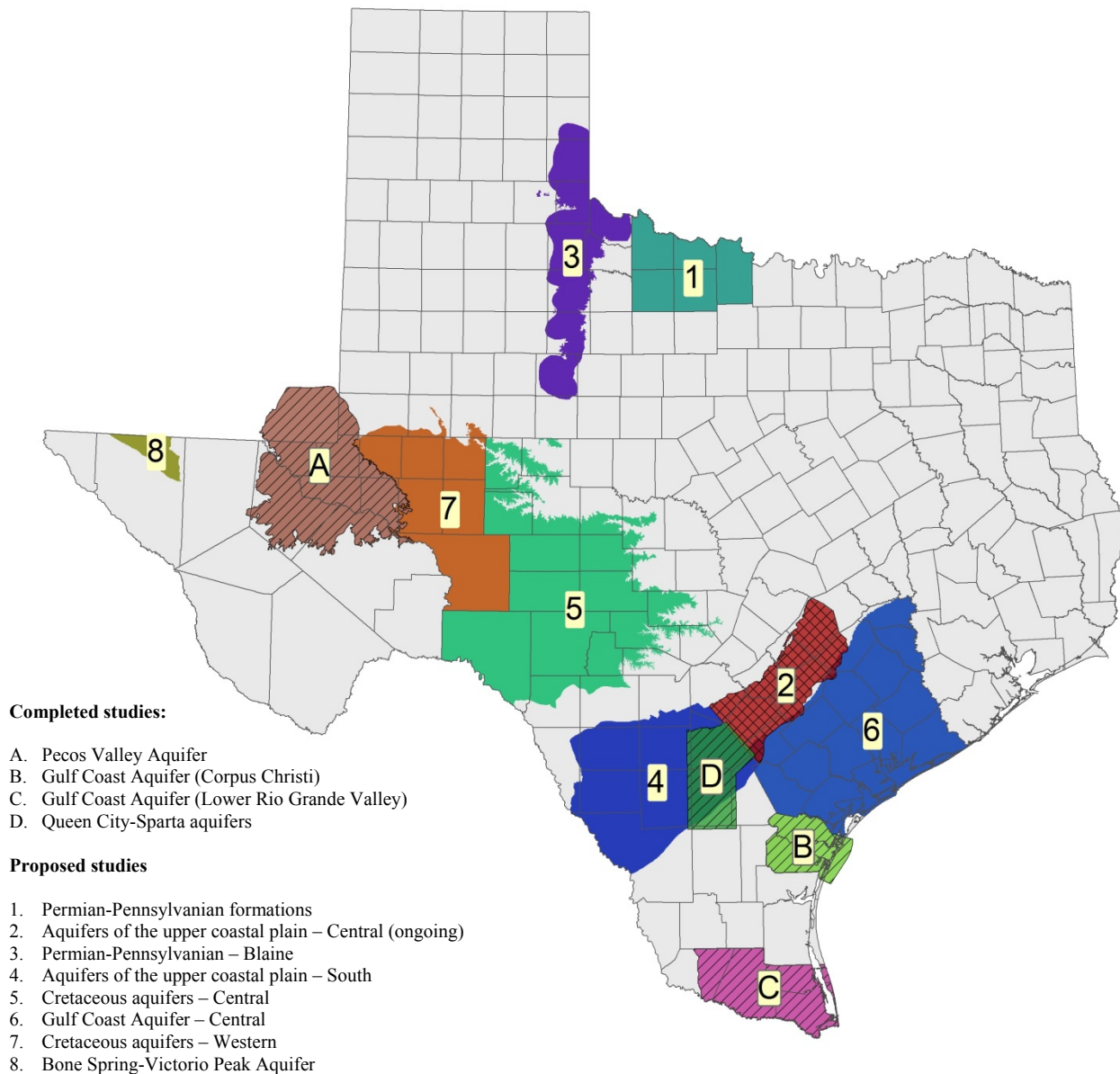
**Rationale for selecting the study areas**

The primary aim of the Brackish Resources Aquifer Characterization System program is to provide information to help regional water planning groups assess the viability of brackish aquifers as potential sources of new water supplies. Thus, we selected aquifers listed in the 2012 State Water Plan associated with recommended brackish groundwater desalination projects for mapping ahead of others that have not been listed.

Furthermore, we considered factors such as the decade of planned implementation of a desalination plant and mapping studies that may have already been conducted in the area or aquifer. Finally, the recent critical water shortage being experienced in some areas of the state due to drought required us to refocus our efforts to these areas. In short, we want to focus and prioritize our efforts on those areas that we think will need the information first.

Proposed studies for aquifer storage and recovery are also based on a rationale similar to the brackish aquifer mapping studies with the additional requirement that they be limited to areas around urban centers (municipal demand centers).

The plan is based on the availability of 4.5 full-time staff members to work on the projects. Presently, we have four full-time staff members in the Brackish Resources Aquifer Characterization System program. In June 2014, we promoted our desalination and reuse expert, Erika Mancha, to the team lead position for Innovative Water Technologies. Because she stills retains this expertise, her vacant position creates the opportunity to acquire expertise in other areas. One of the team members in the Brackish Resources Aquifer Characterization System program, Matthew Webb, has training, interest, and an educational background in aquifer storage and recovery, an area we need additional resources for. Therefore, we plan to (1) assign half of Webb's time to aquifer storage and recovery with the other half of his time continuing to be dedicated to the Brackish Resources Aquifer Characterization System program and (2) hire another person to focus on the Brackish Resources Aquifer Characterization System projects. This results in 4.5 full-time equivalents dedicated to mapping the brackish groundwater resources of the state.



**Figure 1. Proposed, ongoing, and completed brackish aquifer mapping study areas.**